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AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph at page 2, line 28, to page 3, line 3, with the following amended paragraph:

Another embodiment of the invention is directed to an apparatus for autonomous operation over an area comprising a drive system and a controller in communication with ~~said~~ the drive system. This controller includes a processor, for example, a microprocessor, programmed to: provide at least one scanning pattern for a first portion of the area; analyze the first portion for an opening to a second portion of the area; and signal the drive system to move along a path at least proximate the periphery of the first portion to an through the opening to the second area.

Please replace the paragraph at page 3, lines 4-12, with the following amended paragraph:

Another embodiment is directed to an apparatus for autonomous operation over an area comprising a drive system and a controller in communication with the drive system. The controller includes a processor, for example, a microprocessor, programmed to: provide at least one scanning pattern for a portion of the area from a first point; signal the drive system to move along a path at least proximate the periphery of the scanned portion to a second point, the second point at a different location than ~~said~~ the first point; and provide at least one scanning pattern for a portion of the area from the second point.

Please replace the paragraph at page 5, lines 1-2, with the following amended paragraph:

Fig. 13 is a view of the bumper section of the cover and the shock detection system,[;] in accordance with an embodiment of the invention;

Please replace the paragraph at page 5, lines 11-12, with the following amended paragraph:

Figs. 21A and 21B are ~~diagram~~ diagrams of the door sensing system in operation with the apparatus of the invention;

Please replace the paragraph at page 6, lines 19-28, with the following amended paragraph:

Turing also to Fig. 3B, the apparatus 20 is formed if a chassis 50, having a base 52 and an extending portion 54 (Fig. 4), for supporting the components and systems (detailed herein). The chassis 50 rests on drive wheels 72 and a support wheel 74. The ~~the~~ drive wheels 72 are typically limited to a single degree of freedom and are "active", with each drive wheel 72 controlled by conventional axial drive mechanisms 73 (motors, etc.-Fig. 19). The support wheel 74, is "passive", and typically has ~~having~~ multiple degrees of freedom, as it is used for position, distance and orientation control of the apparatus 20 (shown in Fig. 16 and detailed below). This support wheel 74 is, for example, a castor wheel, as detailed in Fig. 16 below.

Please replace the paragraph at page 8, line 27, to page 9, line 5, with the following amended paragraph:

A conduit 154 connects the filtration unit 148 to an impeller chamber 156, that houses an impeller 158, that is rotated by a motor 160. The impeller chamber 156, that houses the impeller 158 and motor 160, is typically formed of shells 161a, 161b joined by mechanical fasteners, adhesives or other conventional arrangements, and a support member 162 (attached to the chassis 50), along a rim 162r. The support member 162 includes a vent 163, formed of bars 163a, the vent 163 open to the ambient environment. This allows for air intake for suction (in the direction toward the impeller 158, or downstream for purposes of this document). This arrangement forms a flow path for particles, that is considered to be indirect, since the filtration unit 148 is before the impeller 158, in the particle flow path.

Please replace the paragraph at page 9, lines 6-15, with the following amended paragraph:

An agitator unit 164 is at the base of the nozzle 140. This agitator unit 164 includes a cover 164a, that typically includes a compartment 165 for accommodating rotating members 166a, 166b, and is positioned upstream of the nozzle 140. The rotating members 166a, 166b are typically brushes or the like, whose rotation is controlled by a conventional rotator motor 308. The agitator unit 164 may include rollers 168 or the like for contact with the surface or ground 183, and may be mounted onto the chassis 50 in a manner, so as to contact the ground or surface 183, providing resistance to it, and adjust to various levels in accordance with the contour of the

ground or surface. There may also be a static brush portion 169 intermediate the rotating members 166a, 166b,

Please replace the paragraph at page 10, lines 1-11, with the following amended paragraph:

The body 172 also includes sidewalls 172a, that border a ~~cutout~~ cut-out edge 182. This cut-out edge 182 defines a second, typically lower, edge of the opening 180, and provides for ground clearance and greater maneuverability. The horizontal orientation of the nozzle body 172, coupled with the lip 178 extending beyond the cutout edge 182, allows a flow cavity to be formed with the floor or surface 183. This cavity is of a constant vertical aperture with respect to the opening 180, as indicated by typically equal lengths 180'. This constant vertical aperture maintains acceleration of the airflow into the nozzle opening 180 and nozzle body 172. Additionally, the cavity, coupled with the shape of the rotating members 166a, 166b creates a horizontal acceleration channel with horizontal air flow for particulates (debris, etc.) into the nozzle 140.

Please replace the paragraph at page 16, lines 17-23, with the following amended paragraph:

Bristles 320, anchored into the core 316 of the rotating member 166a, 166b, by conventional fastening techniques, extend from the core ~~312~~ 316, through the groove 314a, 314b, to slightly beyond the outer surface 322 of the rotating member 166a, 166b. By resting in the grooves 314a, 314b and the grooves 314a, 314b dimensioned as detailed herein, the bristles 320 can bend, so as not to inhibit torque on the rotating members 166a, 166b. These bristles 320 are typically made of nylon or the like.

Please replace the paragraph at page 17, lines 22-30, with the following amended paragraph:

Fig. 12C details another alternate embodiment agitator unit 164". Here, there are two motors 340a, 340b, that typically rotate cams 342a, 342b in opposite directions, as indicated by the arrows 343a, 343b. However, the same direction for rotation is also permissible. Non-motorized cams 344, mounted to the apparatus 20 support belts 345 ~~the~~ that include bristles 320". The belts 345 and bristles 320" travel in a direction substantially perpendicular to the direction of travel of the apparatus 20 (indicated by arrow 75). This substantially perpendicular

direction of travel is sufficient to create the requisite agitation of particulates for suction, as detailed above.

Please replace the paragraph at page 19, lines 9-26, with the following amended paragraph:

In operation, if at least one of the four electrical contacts at the pivot points 365a, 365b is broken, typically as a result of a front, side or top impact to the apparatus 20, a signal will then be sent to the control system 1000, that will then, for example, signal the drive system 1040 to cease motion immediately. In the case of a side impact, the bumper member 360 will move laterally, such that this movement causes at least one of the arms 376 to move out <u>of</u> contact with the band 388. This will also cause a signal to be sent to the control system 1000, that will then, for example, signal the drive system 1040 to cease motion. Specifically, these pivotal and lateral movements are caused by contact to the bumper section 104 at the front of the apparatus 20. The bumper member 360 is configured, for example, such that movements of approximately 2mm or greater to the bumper section 104 or forces as detailed above, will cause these pivotal or lateral movements, to occur, whereby at least one requisite electrical contact is made or broken. This change in electrical contact will result in a signal being sent to the control system 1000, that will signal the drive system 1040 to stop, ceasing motion of the apparatus 20 (as detailed above). Motion ceases within the depression limits of the bumper member 104, that is typically not more than 20 mm.

Please replace the paragraph at page 21, line 25, to page 26, line 9, with the following amended paragraph:

Turning now to Figs. 3B and 19, there is a nozzle height adjusting system 560 (Fig. 23), coupled to the control system 1000, that raises and lowers the nozzle 140, in response to the surface, and in some cases, obstacles detected. The nozzle 140 includes a bracket 561 with an opening 562 therein. This opening 562 is engaged by a rod 564 attached to an adjustment mechanism 566, and with associated electronics, is coupled to the control system 1000. The nozzle 140 is spring mounted, and can be pushed upward, to contact a metal or magnetic portion 570 of a member 572 within a spring. The end of the metal member ~~570~~ <u>572</u> is detected by a magnet (magnetic sensor) 580, for example, a hall effect sensor, that senses a position change for the member 572, and will indicate this change, via signals or the like, to the control system 1000,

that will signal the adjustment mechanism 566, typically including a motor 566a. This motor 566a will drive an eccentric member 566b, that translates rotation of vertical movement by moving the rod 564, and therefore, the nozzle 140 up to the proper position. (The nozzle 140 will move down provided there is open space between the rotating members 166a, 166b, i.e., brushes, and the surface, as detailed below).

Please replace the paragraph at page 22, lines 10-21, with the following amended paragraph:

The nozzle height adjustment system 560, in particular, the adjustment mechanism 566, typically functions to set only the minimum height for the nozzle 140 and rotating members 166a, 166b (i.e., brushes) (since the nozzle 140 is attached to the rotating members 166a, 166b, they are treated as a single unit-nozzle/rotating members, for purposes of this example description). Accordingly, it can adjust the nozzle 140/ rotating members 166a, 166b, for higher surfaces automatically, since the nozzle 140/ rotating members 166a, 166b can travel freely upward. The minimum height is required to keep the nozzle 104/rotating members 166a, 166b (i.e., brushes) at a desired height, and therefore, reducing the load on the nozzle/rotating members, as induced by the carpet. On hard floors or other surfaces, the rollers 168 maintain the nozzle 140/brushes 166a, 166b at the correct height.

Please replace the paragraph at page 23, lines 3-13, with the following amended paragraph:

Turning also to Figs. 20, 21A and 21B, <u>a</u> door detection sensor 30a is typically formed of ~~formed of~~ two infra-red (<u>infrared or</u> IR) transmitters 600a, 600b, while the other door detection sensor 30b is typically formed of an IR receiver(s) 602. The transmitters 600a, 600b are positioned at an angle Θ, with respect to each other, that is, for example, approximately 20-30 degrees, and at a distance zz from each other, for example, approximately 10 mm. One transmitter, here, transmitter 600a, and the receiver 602 are typically also tilted approximately 5 degrees (into the plane of the paper). This <u>tilting</u> ~~titling~~ limits potentially unwanted reflections from horizontal highly reflective surfaces such as metal door frames, mirrors, lights, reflectors, etc., since most of the light energy in these cases will be projected 10 degrees forward rather than returning to the receiver 602.

Please replace the paragraph at page 23, lines 21-26, with the following amended paragraph:

The transmitters 600a, 600b, by being arranged at this angle Θ, can detect the desired doors, and entryways for these doors, while distinguishing them from other locations, such as under tables, counters or the like. In operation, the transmitters 600a, 600b, emit light beams 609a, 609b (illustrated in Figs 21A and 21B for description purposes). The range for the receiver 602 ~~600~~ is also represented by a beam 610 (also, only for description purposes).

Please replace the paragraph at page 23, lines 27-30, with the following amended paragraph:

In Fig. 21A, should a door be detected, the receiver 602, will detect a reflection of a beam from the corresponding transmitter 600a (illustrated by ~~overlapping~~ beams 609a, 610) off of the retro-reflector 606, while the receiver 602 ~~600~~ will not detect a reflection from the second transmitter 600b.

Please replace the paragraph at page 23, line 31, to page 24, line 3, with the following amended paragraph:

In Fig. 21B, should an area of lower clearance than a ceiling or doorjamb be detected, such as a table 611 or the like, some portions of the light (beams) emitted from both transmitters 600a [.] and 600b will be detected by the receiver 602, as illustrated by the arrows 609ar, 609br, being within the range of the receiver beam 610.

Please replace the paragraph at page 24, lines 4-10, with the following amended paragraph:

As these transmitters 600a, 600b and receiver 602 are in electronic communication with the control system 1000, the requisite signals, based on whether or not light, from zero, one or both sensors (transmitters) 600a, 600b was received (by the receiver 602), are sent to the control system 1000. This control system 1000, as detailed above, will signal the drive system 1040 (Fig. 23) ceasing motion of the apparatus 20, or changing direction of the apparatus 20, as per the determined travel (cleaning) pattern, as detailed below.

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Please replace the paragraph at page 25, lines 3-7, with the following amended paragraph:

For example, the obstacle sensors may be units, such as 40Khz ultrasonic transducer, Part No. 400PT160, from Prowave. These ultrasonic sensors 34, 35, 36a, 36b, 37 define an array, and function as proximity sensors (of a proximity sensing system), that when coupled with the control system 1000, can provide a low resolution image of the obstacle path in ~~from~~ front of the apparatus 20.

Please replace the paragraph at page 25, lines 8-14, with the following amended paragraph:

Another sensor of the obstacle sensors is a sensor 38, typically for horizontal object, for example, shelf, detection. This sensor 38 typically includes a transmitter portion and a receiver portion, angularly upward (for example an angle of approximately 35 degrees with respect to the horizontal). This sensor 38 is typically a Position Sensing Diode (PSD), formed from ~~Infra-red~~ infrared transmitting and receiving components, and, for example, may be a Sharp® infra-red sensor unit, Part No. GP 2D12 14 from Sharp Electronics, Japan.

Please replace the paragraph at page 25, lines 15-20, with the following amended paragraph:

As the aforementioned ultrasonic sensors may not detect all horizontal objects with small vertical portions, this sensor 38 provides the requisite horizontal object detection. It also functions in combination with obstacle sensors 36a, 36b, 37 (and the control system 1000) to create a local map. Should a low obstacle be detected, a signal will be sent to the control ~~unit~~ system 1000, that will signal the drive system 1040, ceasing motion of the apparatus 20, as detailed above.

Please replace the paragraph at page 26, lines 5-9, with the following amended paragraph:

The remote control sensors 40 are typically ~~an~~ infra-red (infrared or IR) sensors. They are coupled to the control ~~unit~~ system 1000, that accepts commands from the remote controller 46, transmitted in the form of infra-red light. They are positioned frontally and laterally in the

apparatus 20 (Figs. 1 and 13) to receive signals from the remote controller 46 regardless of the position of the apparatus 20.

Please replace the paragraph at page 26, lines 10-15, with the following amended paragraph:

The remote controller 46 is typically an infra-red <u>(infrared or IR)</u> remote controller (as detailed above) or the like. This remote controller 46 can signal directly to the control system 1000 (as the remote control sensor 40 is coupled to the control system 1000) various commands, such as ON/OFF, various travel modes, various cleaning modes and patterns, strengths of cleaning, speed of the apparatus, etc.

Please replace the paragraph at page 29, line 31 to page 30, line 5, with the following amended paragraph:

If the scanning did not satisfy the predetermined condition, the scan direction is changed, at block 1222. The process then returns to block 1202. Changing of the scanning direction, for example, can involve a turning movement of approximately 45 degrees by the apparatus 20, with scanning typically employing the same footprint, as was determined at block 1202. Other turning angles are also permissible, and can be programmed or entered into the control system <u>1000</u>, for example, through the remote controller 46.

Please replace the paragraph at page 31, lines 18-20, with the following amended paragraph:

Here, blocks 1201', 1202', 1204', 1206' and 1208' are similar to corresponding blocks 1201, 1202, 1204, ~~1208~~ <u>1206,</u> and 1208, that have been described above, those descriptions applicable here.

Please replace the paragraph at page 32, lines 3-6, with the following amended paragraph:

Alternately, this contour movement of block 1252, in particular<u>,</u> its length or distance to be traveled "D"<u>,</u> can be determined "on the fly" or dynamically, based on an estimate of the circumference or perimeter of the room, area, or portion thereof, to be or being scanned, in accordance with following formula:

Please replace the paragraph at page 32, lines 15-16, with the following amended paragraph:

d is the diameter of the apparatus, for example, apparatus 20, expressed in meters.

Please replace the paragraph at page 32, lines 17-23, with the following amended paragraph:

In accordance with the processes detailed in Figs. 24A and 24B, the microprocessor 1004 is also programmed for all of the above detailed cleaning and travel modes and combinations thereof. The microprocessor 1004 operates in conjunction with the main board 1002 and control system 1000, for all of these additional cleaning and travel modes. The microprocessor 1004 is also programmed to determine distances traveled for odometers of the drive 72 and ~~guide~~ support 74 wheels ~~74~~.